J. Raptor Res. 22(4):107–115

NESTING AND FORAGING HABITAT OF GREAT GRAY OWLS

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Abstract.—During 1982–1986, 46 Great Gray Owl (*Strix nebulosa*) nests were located in northeastern Oregon. Twenty-five of these nests were on stick platforms, 11 were on artificial platforms, and 10 were on broken-topped dead trees. Mean dbh and height of trees containing stick nests were 58 cm and 30 m, respectively, and the majority (76%) of nests were in live western larch (*Larix occidentalis*). Broken-topped dead trees with nests averaged 78 cm dbh and 11 m tall. Forest types in which nests were found included: Douglas-fir (*Pseudotsuga menziesii*)-grand fir (*Abies grandis*) (50%); western larch-lodgepole pine (*Pinus contorta*) (29%); ponderosa pine (*Pinus ponderosa*)-Douglas-fir (15%); and ponderosa pine (7%). Nesting males foraged primarily in mature, open stands (11–59% canopy closure) of ponderosa pine or Douglas-fir.

The Great Gray Owl (*Strix nebulosa*) is the largest strigiform found in North America and is an impressive owl of great interest to bird enthusiasts. This circumpolar species is widespread and occurs in boreal forests from Alaska, east to Ontario, south to Idaho, western Montana, northwestern Wyoming, northern Utah, northern Minnesota, northern Wisconsin, and the Sierra Nevada in California; in Eurasia, this owl occurs in northern portions of Scandinavia, Russia and Siberia (American Ornithologists' Union 1983).

Surprisingly little is known about the Great Gray Owl, making management difficult. To manage for the species, information on the habitat used for nesting and foraging is essential. If foraging habitat is lacking and prey densities are low, the owls will not nest even if nest sites are available. If prey is adequate and nest sites are lacking, again there will be no nesting.

Because these owls depend on existing nest platforms such as old raptor nests, broken-topped dead trees, and artificial platforms (Nero 1980; Mikkola 1983; Winter 1986; Bull et al. 1987; Franklin 1987; Forsman and Bryan 1987), managers have a good opportunity to manage the species by providing nest platforms where they want the owls—provided there is adequate prey and habitat to support them. It is therefore essential to know what habitats are suitable for nesting and foraging.

Our objectives were to determine habitat used for nesting and foraging of Great Gray Owls during the breeding season in northeastern Oregon. Nesting habitat included the nest tree and the area surrounding the tree, in addition to the habitat used by juveniles after fledging who were still dependent on the adults. Foraging habitat included areas used by males who were feeding females and offspring.

[1] Deceased.

Study Area

During March–May 1982 we surveyed for Great Gray Owls in 2 large areas: the area within a 60-km radius around La Grande, Oregon and a 50 km^2 area 47 km north of Enterprise, Oregon. During 1983–1986 survey efforts were confined to 4 areas where Great Gray Owls were located in 1982—the Spring, Bowman, Sheep and Thomason study areas.

Forest types in each area were categorized using a modification of Burr's (1960) classification by tree species in the dominant and codominant crown classes. Dominant trees were defined as those with crowns extending above the general level of the crown, and codominant trees were those whose crowns formed the general level of the crown (Smith 1962:33). Each of the 4 study areas contained 4 different forest types: 1) ponderosa pine (*Pinus ponderosa*), 2) ponderosa pine–Douglas-fir (*Pseudotsuga menziesii*), 3) Douglas-fir–grand fir (*Abies grandis*), and 4) western larch (*Larix occidentalis*)-lodgepole pine (*Pinus contorta*).

Successional stages in each area were classified based on tree size and stand structure as subclimax, mature, over-mature and remnant. In subclimax stands all trees were <30 cm dbh; in mature stands the largest trees were 30–50 cm dbh; over-mature stands were unlogged and larger trees were ≥50 cm dbh; remnant stands were typically logged and had 1–3 trees/ha ≥50 cm with the remainder of trees <30 cm. The remnant stage identified stands that did not resemble unlogged over-mature stands but contained a few large-diameter trees.

The Spring study area (44 km^2) was 17 km west of La Grande at 930–1140 m elevation. Cover types included conifer forest (63% of area), shallow-soiled grasslands (32%) and clearcuts (5%). During the previous 10 yrs, 66% of forested stands within the Spring study area had been selectively logged. As a result most forests in this area consisted of open, park-like stands dominated by ponderosa pine. These stands were on deep soils with a dense cover of grasses. Isolated stands of unlogged, large trees (≥50 cm dbh) comprising 22% of this study area remained Isolated stands contained Douglas-fir, lodgepole pine,

Table 1. Characteristics of 3 types of Great Gray Owl nest structures at 46 nest sites in northeastern Oregon, 1982–1986.

Characteristic	Nest Structure					
	Stick		Broken-topped Tree		Wooden Platform	
No. nests in Spring	16		1		4	
No. nests in Bowman	3		2		2	
No. nests in Sheep	5		1		—	
No. nests in Thomason	1		6		5	
Nest tree species						
Western larch	76%		10%		45%	
Douglas-fir	20%		20%		—	
Ponderosa pine	4%		70%		36%	
Lodgepole pine	—		—		18%	
	$\bar{x}$	S.D.	$\bar{x}$	S.D.	$\bar{x}$	S.D.
Nest height (m)	17	5.05	11	3.88	12	3.01
Tree dbh (cm)	58	17.16	78	15.24	58	17.20
Tree height (m)	30	4.98	11	3.65	29	8.73
Bole height (m)	10	5.00	8	4.24	13	6.59
Tree age	151	35.07	173	25.40	129	51.73

western larch, and occasionally grand fir. A total of 52 artificial nest platforms were erected in 1984 in the Spring area.

Bowman (27 km^2) was 50 km west of La Grande at 1380–1500 m elevation. Cover types included coniferous forest (68%), shallow-soiled grasslands (20%) and clearcuts (12%). Dense stands of lodgepole pine or mature and over-mature stands of grand fir and Douglas-fir with some western larch and ponderosa pine dominated the Bowman area. About 60% of the forested area had been logged in the 15 yrs prior to our study; lodgepole pine stands had been clearcut, and ponderosa pine and Douglas-fir stands had been selectively logged. Fifty-four artificial nest platforms were erected in this area in 1984.

Sheep (78 km^2) was 37 km southwest of La Grande at 1290–1500 m elevation. Cover types included coniferous forest (68%), clearcuts (12%), wet meadows along streams (12%) and shallow-soiled grasslands on ridges (8%). Ponderosa pine forests occurred on south-facing slopes, and lodgepole pine stands or mixed stands of Douglas-fir, western larch and grand fir occurred on north-facing slopes. Greater than 80% of the forested area had been logged (40% clearcut and 60% selectively logged) during the 15 yrs prior to this study.

Thomason (34 km^2) was 47 km north of Enterprise at 1350–1470 m elevation. Cover types included coniferous forest (71%) and wet meadows (29%). Forest stands were lodgepole pine and ponderosa pine or mixed stands of Douglas-fir, western larch and grand fir. About 80% of the area had been selectively logged in the 10 yrs prior to this study. There were 38 artificial nest platforms in Thomason at the onset of this study.

METHODS

Locating Birds and Nests. Owls were located after dark in February, March and April by imitating the territorial call of a male Great Gray Owl every 0.1 km while walking through each study area. Areas containing owls were searched for active nests during the day.

Radio Telemetry. Adult Great Gray Owls were captured with bal-chatri traps, noose poles and mist nets (Bull 1987). Radio transmitters (AVM Instrument Co.—SM1, L Module) were placed on 10 males and 13 females and 35 post-fledging juveniles. Transmitters were attached to the bird with a back-pack harness of 6 mm tubular teflon ribbon. The entire package weighed 25 g and lasted 242–505 d. A Telonics TR-2 receiver with a hand-held 2-element Yagi antenna was used for locating owls.

Adult radio-tagged owls were located each spring at their nests. Juveniles were located every 1–3 d for 7 d after fledging. Eight nesting males were followed in the morning (first light until roosting) and evening (departure from roost until dark) 1–2 times/wk from the time transmitters were put on until 2 mo after fledging, or until the radio failed or the nest was abandoned.

Habitat Quantification. Variables recorded at nests included nest type (stick, broken-topped dead tree, or artificial platform), nest height (m), tree species, dbh (cm), height (m), age (increment bore used), and bole height (height of lowest live branch) (m) (Table 1). Stick nests were classified as natural platforms created by dwarf mistletoe (*Arceuthobium* spp.) or as vacated nests built by Northern Goshawks (*Accipiter gentilis*) or Red-tailed Hawks (*Buteo jamaicensis*). At 4 sites we saw hawks con-

Table 2. Habitat characteristics in circular 0.1-ha plots centered on 46 Great Gray Owl nests in northeastern Oregon, 1982–1986.

CHARACTERISTIC	$\bar{x}$	S.D.	FREQUENCY
Forest type			
Douglas-fir–grand fir			50
Lodgepole pine–western larch			29
Ponderosa pine–Douglas-fir			15
Ponderosa pine			7
Successional stage			
Mature			26
Over-mature			41
Remnant			33
Logging			
None			72
Partial cut			19
Adjacent to clearcut			9
Canopy closure (%)			
0–10			7
11–59			30
≥60			63
Live trees/0.1 ha ≥50 cm dbh	3.2	2.51	
Dead trees/0.1 ha ≥50 cm dbh	1.0	2.10	
Live trees/0.1 ha <50 cm dbh	26.7	14.70	
Dead trees/0.1 ha <50 cm dbh	9.2	7.80	
Leaning trees/0.1 ha <10 cm dbh	5.1	14.45	
Regeneration (trees/0.1 ha)	41.8	55.47	
Distance to water (m)	231.6	209.98	
Distance to clearing (m)	77.1	70.13	

structing nests in prior years; at the remainder, a nest below the canopy in a dense forested stand was classified as an old Goshawk nest, and a nest high in the canopy of a more open forest was classified as an old Red-tailed Hawk nest.

In a circular 0.1-ha plot centered on each nest, we recorded the variables listed in Table 2. Regeneration included all trees ≤10 cm dbh. We also recorded landform (flat, draw, or slope), slope aspect and gradient, number of canopy layers and height (m) of tallest canopy. With aerial photos (scale 1:24 000) and a planimeter, we determined the percent area in forest, grassland, clearcut and selectively logged forest within a 500-m radius of each nest. The linear distance in edge between forest and grassland within the 500-m radius was calculated with a map measure. Edge was defined as a 60-m wide band where forests and openings met.

Juvenile owls were located every 1–3 d during the week after fledging. Each time a juvenile owl was located, we recorded type of perch used (branch, leaning tree, or top of a broken-off dead tree) and perch height. Tree species, condition (live or dead), dbh, and height of the tree used for perching were measured. In addition we noted the presence of leaning trees that provided owlets access to perches in upright trees. For the next 2 mo, juveniles were located every 1–2 wks and locations recorded on aerial photographs.

While following radio-tagged males, activity and habitat use data were recorded at 15-min intervals and each time an owl hit the ground when pursuing prey (hereafter referred to as a foraging site). Activity categories were hunting or roosting. Birds actively searching for prey, flying from perch to perch, and staring intently at the ground were classified as hunting. Birds quietly perched in a tree next to the trunk and not watching the ground intently were classified as roosting.

Every 15 min we recorded location of the bird on an aerial photo, estimated canopy closure over the bird and recorded forest type, successional stage, physiognomy of the stand (open or dense forest or edge), logging activity, number of stand layers, type of perch and tree species supporting perch. If a bird was roosting when first located, we recorded the data once and waited until the bird left the roost before continuing.

At each foraging site we recorded percent, height and type of ground cover within a 1-m radius, presence or absence of downed wood within a 1-m radius, diameter (at largest point) of the downed wood, distance owl flew to prey, height of perch, diameter of perch tree and distance to nest. Home range of hunting males was delineated by connecting the outermost radio locations to form minimum convex polygons which were then measured with a planimeter.

LANDSAT data (Isaacson et al. 1982) were used to determine forest canopy closure classes (0–10%, 11–59% and ≥60%) available in 3 of the study areas and in the home range of 5 of the 8 males. The 0–10% class comprised openings; the 11–59% class contained relatively open stands, many of which had been selectively logged; the ≥60% class was primarily unlogged, overmature forest stands.

Density. We calculated density of active nests of Great Gray Owls in Spring and Thomason by counting the number of nests within a polygon defined by the outermost nests in 1984. We chose 1984 because we believe all nesting pairs within the polygons were located that year. We did not present the density as number of nests/study area because we believe all nests in the study areas were not found.

Analysis. Chi-square analyses were used to compare the observed number of foraging locations in each canopy closure class and in edge with the expected number of locations based on the percent edge and canopy closure classes in the home range of each radio-tagged male. We compared habitat characteristics of hunting birds in Spring with those in Bowman and Sheep using a Chi-square analysis. Habitat used by 3 birds studied in Sheep and Bowman were combined because of the small sample size and because the 2 areas had similar habitat and logging activity. We used $P < 0.05$ as the level of significance. We could not test for preference for nest type or nest habitat because we did not determine the number or distribution of available nest sites.

RESULTS

Nest Sites. During 1982–1986, we located 46 nests, 14 of which were used more than once (Table 1). Of the 14 nests used more than once, 6 were used 2 years, 6 were used 3 years, 1 was used 4 years, and 1 was used twice in the same year, so we observed 69 nesting attempts on 46 nest structures. Fifty-four pecent of the nests were stick platforms, 24% were artificial platforms and 22% were natural depressions on broken-topped dead trees (Table 1). Of the stick nests, 68% were originally made by Northern Goshawks, 12% were made by Red-tailed Hawks and 20% were natural platforms created by dwarf mistletoe infections.

All 3 types of nests were commonly used, although nests in broken-topped trees and wooden platforms had a lower rate of nest failure (20%) than did nests in stick platforms (34%), suggesting that the latter was a less stable structure because young or eggs fell through on at least 4 occasions. The majority of stick nests were in large diameter (≥50 cm dbh) live western larch (Table 1). The majority of nests in broken-topped dead trees were in large diameter ponderosa pine at least 7 m tall. Nests in wooden platforms were at least 9 m above the ground in live trees.

The mean size of 11 stick nests was 74 cm (SD = 17.32) long, 65 cm (S.D. = 11.97) wide, 27 cm (S.D. = 14.04) high, with a depression 7 cm (S.D. = 2.70) deep. The only nest on a broken-topped dead tree that was measured had a circular depression in the top of the tree that was 56 cm in diameter and was 26 cm deep.

The majority of the nests occurred in Douglas-fir–grand fir forest types and in over-mature and remnant stands (Table 2). Sixty-nine percent of nests occurred on slopes, 22% on flat ground, and 9% in draws; mean slope gradient at nests was 13% (S.D. = 9.28). Sixty-five percent of nests were on north-facing slopes. Northern aspects are preferred by Northern Goshawks (Reynolds et al. 1982), the primary builder of nests used by Great Gray Owls.

Western larch comprised the dominant crown class at 52% of nest sites, ponderosa pine 28%, and Douglas-fir and grand fir the remainder. Ponderosa pine comprised the dominant crown class at nests in Thomason, and western larch comprised the dominant crown class in the other study areas. The co-dominant crown class was comprised of lodgepole pine at 51% of the nests, Douglas-fir at 31% and ponderosa pine at 18%.

Seventy-two percent of nest sites had not been logged, but 60–80% of stands in each study area had been logged. Forty-four (96%) of 46 nest sites had ≥ 2 canopy layers, the tallest layer having a mean height of 34 m (S.D. = 4.90). Density of live trees < 50 cm dbh at nest sites ranged from 5–64 stems/0.1 ha, and of live trees ≥ 50 cm dbh ranged from 0–10 stems/0.1 ha. Density of dead trees ranged from 0–36 stems/0.1 ha at nest sites. Regeneration ranged from 0–290 stems/0.1 ha.

Area in forest within a 500-m radius of each nest ranged from 52–99%, and forested area that had been logged ranged from 0–97%. The amount of edge between forests and openings within 500 m of the nest averaged 4.2 km (range = 0.7–8.3 km). The amount of area in natural openings within 500 m of the nest ranged from 0–40%. Nests in Thomason contained the greatest amount of natural opening ($\bar{x}$ = 25%), and nests in the other 3 study areas contained 13–15%. Bowman contained the greatest amount of clearcut area (13%) within 500 m of nests; nests in the other 3 areas contained ≤6%. Total area in openings (natural and clearcut combined) ranged from 18–26%.

Nest Site Fidelity. We observed 18 nesting attempts by 9 pairs where at least 1 member of each pair was radio-tagged. Of the 18 nesting attempts, 39% were on the same nest the next year, 39% were within 1 km of the nest used the previous year, and 22% were farther than 1 km away from the nest used the previous year. Average distance between alternate nests was 1.3 km (range = 0.2–4.5 km, Fig. 1). In 4 cases in which a bird or a pair moved farther than 1 km from their previous year's nest, we found previous nest sites occupied by new pairs.

Density. Shortest distance between 2 active nests was 430 m; 2 other nests were 460 m apart. In 1984 the minimum density of owls was 7 pairs/9.4 km^2 (entire study area was 44 km^2) at Spring and was 5 pairs/2.9 km^2 (entire study area was 34 km^2) at Thomason. At Spring, 2 different females used the same nest in 1984 and were counted as 2 pairs.

Perches Used by Juveniles. Owlets left the nest before they could fly but were capable climbers, using talons, bills and wings to claw and flap their way up tree trunks. For the first few days, leaning trees with bark were easiest for the young to climb. After several days, juveniles could climb up some vertical trees, particularly those with branches or deeply fissured bark (characteristic of large-diameter trees). As owlets aged, they perched higher in the

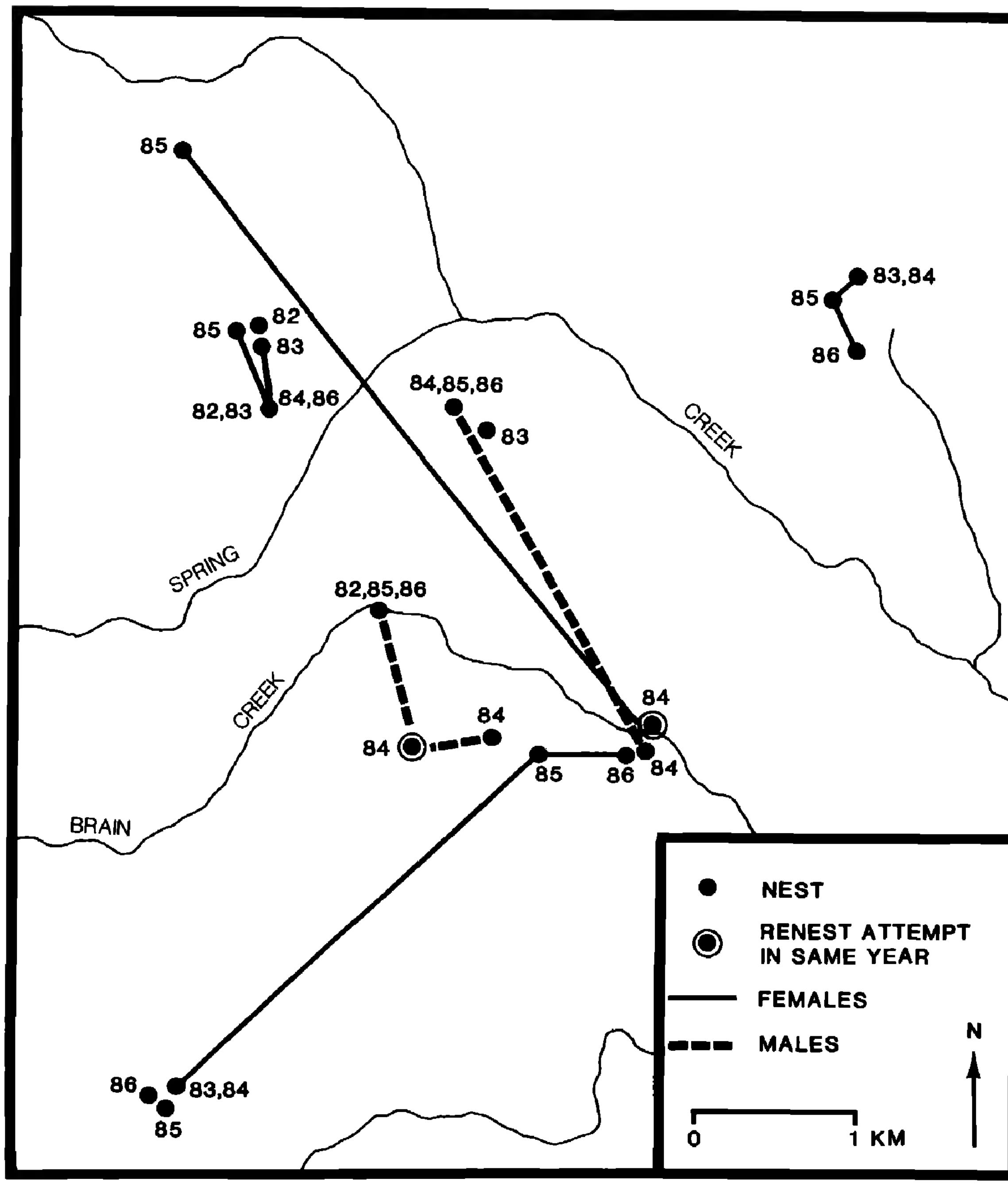

Figure 1. Locations of nests of radio-tagged Great Gray Owls in Spring area 1982–1986. Lines connect nests used in successive years by the same bird.

canopy. Perches used the first week after the young left the nest averaged 6.2 m (S.D. = 4.13) above the ground, had an average canopy closure of 50% (S.D. = 22.16) and were all within 200 m of the nest.

Of 116 perches used by juveniles, 67% were leaning trees or trees which could be reached by climbing a leaning tree; the remainder were branches or broken-topped trees. Leaning perch trees were typically small-diameter ($\bar{x}$ = 16 cm, S.D. = 7.82) lodgepole or ponderosa pine, with an average of 87% (S.D. = 23.80) of the bark remaining. Branches used as perches were typically in live ponderosa pine or Douglas-fir trees with a mean dbh of 37 cm (S.D. = 20.10).

After leaving the nest, juveniles typically moved toward dense forest cover (if the nest was not in a dense stand). Within 2 wks after fledging juveniles gradually became more mobile but generally stayed within forest stands with ≥60% canopy closure (Fig. 2). Family group C ranged the farthest and roosted less frequently in stands with dense canopies than did other family groups (Fig. 2).

Foraging Habitat. During 229 hrs of radio-tracking 8 male Great Gray Owls, we recorded 223 foraging sites and 622 hunting locations at 15-min intervals. Males usually hunted in open forested stands from perches close to the ground. Hunting perches averaged 5.5 m (S.D. = 6.65) high and were in trees with mean dbh of 27 cm (S.D. = 14.06). Mean distance males flew from perches to prey was 10.5 m (S.D. = 9.39). Vegetative ground cover at foraging sites averaged 88% with an average plant

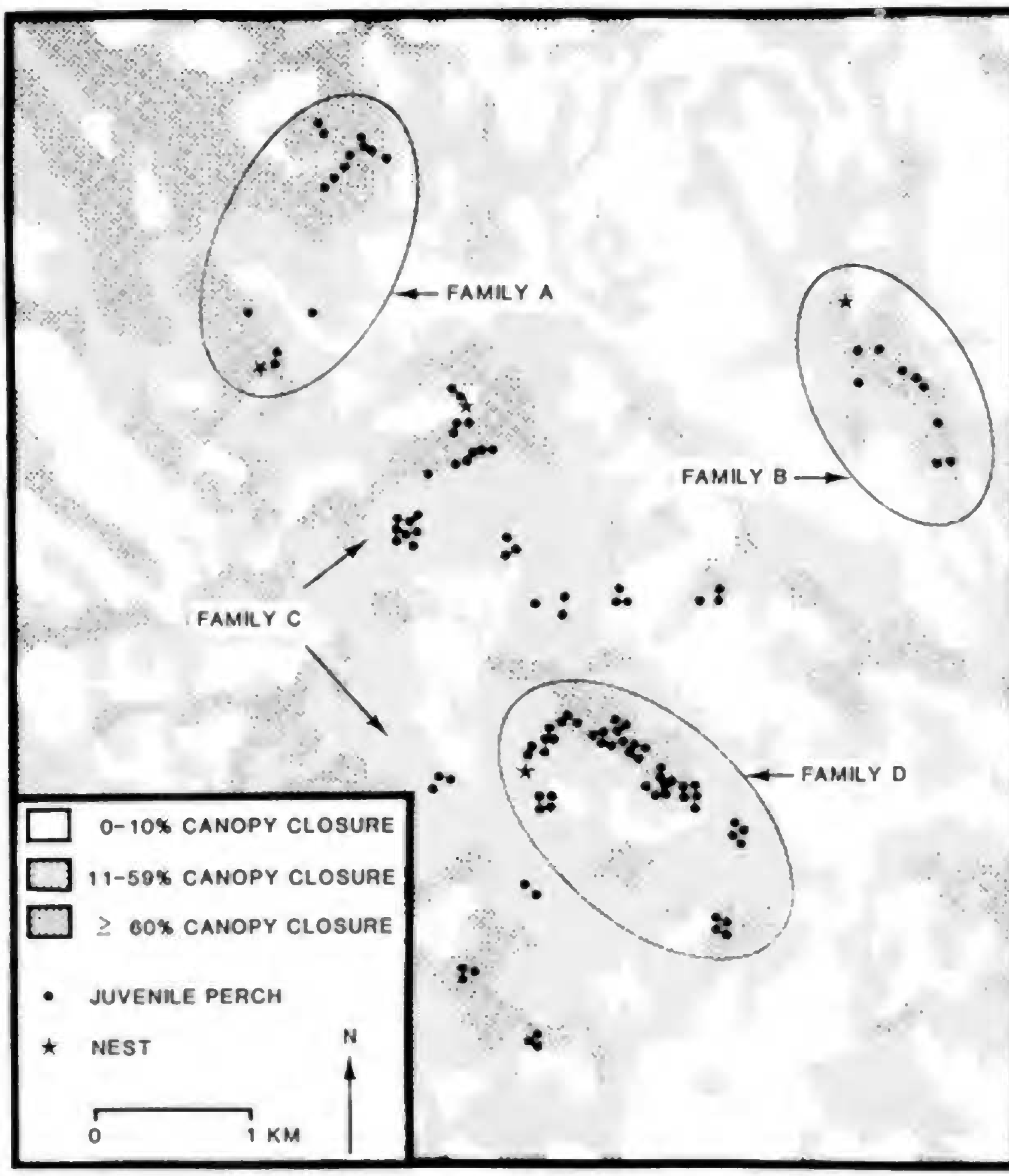

Figure 2. Location of nests and perches used by juveniles of 4 Great Gray Owl family groups in Spring study area. Juveniles were located during 2 mo after fledging. Family groups A and B nested in 1983, and family groups C and D nested in 1985.

height of 21 cm. Grasses dominated in 96% of the sites. Downed wood with a mean diameter of 20 cm was present within 1 m in 77% of the sites.

Mean distance the 8 males moved from the nest when hunting was 0.62 km. One male foraged no further than 0.7 km from his nest, whereas the greatest distance foraged by a male was 3.2 km. Home range of 5 males with ≥ 90 foraging locations averaged 4.5 km^2 (range = 1.3–6.5 km^2).

There was a significant difference in canopy closure of stands used for foraging by 5 males compared to expected use based on availability (χ^2 values for 5 males: 48.1, 41.1, 37.3, 109.8, 58.4; 2 df, $P < 0.01$). Males preferentially foraged in stands with 11–59% canopy closure and avoided clearings. Four of the males avoided stands with >60% canopy closure, while 1 male used such stands in proportion to their occurrence. Use of edge was significantly greater ($P < 0.05$) than expected with 2 males, less than expected with 2 males, and not different than expected with 1 male.

There were significant differences between 5 foraging males at Spring and 3 at Sheep and Bowman in all habitat variables measured except canopy closure (Table 3). Males at Spring hunted more often in stands that were open, logged, younger, with 1–2 canopy layers and containing more ponderosa pine than did males at Sheep and Bowman (Fig. 3). Males at Sheep and Bowman hunted more often in stands that were unlogged, older, with 2–3 canopy layers and containing more Douglas-fir and lodgepole pine.

Males roosted during the day in stands with 11–59% canopy closure (71%) and stands with 60% or more canopy closure (29%). Eighty-three percent of 62 roost sites were in mature or older stands with 2 or more canopy layers. Sixty-eight percent of roosts were in unlogged stands. Owls roosted at least 7 m above the ground 56% of the time, 3–6 m above the ground 38% of the time and lower than 3 m 6% of the time.

DISCUSSION

Great Gray Owls are versatile in their use of nest structures and readily use artificial nests. In Finland Mikkola (1981) observed the species using nests on branches, on stumps, on the ground, on a cliff and on a barn. Great Gray Owl use of artificial nest structures has been reported by Nero et al. (1974), Nero (1982) and Helo (1984) and provides opportunities for management. Owls may prefer artificial structures over natural platforms; 3 females in our study nested on platforms even though stick nests were available nearby.

Great Gray Owls are flexible in their use of habitats as well. Nero (1980) and Servos (1986) found Great Gray Owl nests in poplar (*Populus* spp.) and tamarack (*Larix larcinia*) trees adjacent to muskeg in Canada. Winter (1986) found nests on dead trees in conifer forests only within 260 m of meadows in California. Harris (1984) described nests in forests of tamarack and black spruce (*Picea mariana*) in Canada, and Mikkola (1981) reported nests in dense spruce and pine forests, deciduous stands, wet spruce moors, and swamps in Finland and Sweden. Mikkola (1981) suggested that the owls preferred edges of older stands rather than the interior of large, dense forests. In Oregon we found Great Gray Owl nests in all forest types available within the study areas; however, the majority of nests were in over-mature or remnant stands of Douglas-fir and grand fir forest types on north-facing slopes.

Although the majority of each study area had been logged within 15 yrs of our study, 72% of nests occurred in unlogged stands. Either owls preferred unlogged stands or there was a disproportionate number of potential nest sites in stands, as logging activities often remove large-diameter live and dead trees that could support nests.

Leaning trees and dense cover near nests are important habitat components for fledglings. Owlets left the nest before being able to fly, but leaning trees enabled owlets to climb to perches above the ground. Without leaning trees owlets would be vulnerable to terrestrial predators.

Male Great Gray Owls foraged in a variety of habitats; partially logged stands did not appear to be detrimental, as 62% of foraging locations occurred

Table 3. Foraging site characteristics of 8 nesting male Great Gray Owls in northeastern Oregon, 1985 (data in percent).

CHARACTERISTIC	SPRING (N = 357)	SHEEP/ BOWMAN[a] (N = 265)
Forest type ($\chi^2 = 264.2$, 3 df, $P < 0.01$)		
Ponderosa pine	62	3
Ponderosa pine–Douglas-fir	25	5
Douglas-fir–grand fir	11	60
Lodgepole pine–western larch	2	32
Successional stage ($\chi^2 = 12.1$, 3 df, $P < 0.01$)		
Subclimax	23	17
Mature	61	58
Over-mature	6	6
Remnant	10	19
Physiognomy of stand ($\chi^2 = 82.6$, 2 df, $P < 0.01$)		
Open forest	84	51
Edge	14	30
Dense forest	2	19
Logging ($\chi^2 = 54.2$, 2 df, $P < 0.01$)		
Unlogged	25	49
Partial cut	74	46
Clearcut	1	5
No. stand layers ($\chi^2 = 130.6$, 2 df, $P < 0.01$)		
1	46	13
2	52	54
3	2	33
Perch location ($\chi^2 = 28.3$, 2 df, $P < 0.01$)		
Branch	68	55
Trunk	27	25
Leaning tree	5	20
Tree species of perch ($\chi^2 = 318.2$, 3 df, $P < 0.01$)		
Ponderosa pine	82	7
Lodgepole pine	9	55
Douglas-fir	7	25
Other	2	13

[a] The 3 birds in Sheep and Bowman were combined due to sample size.

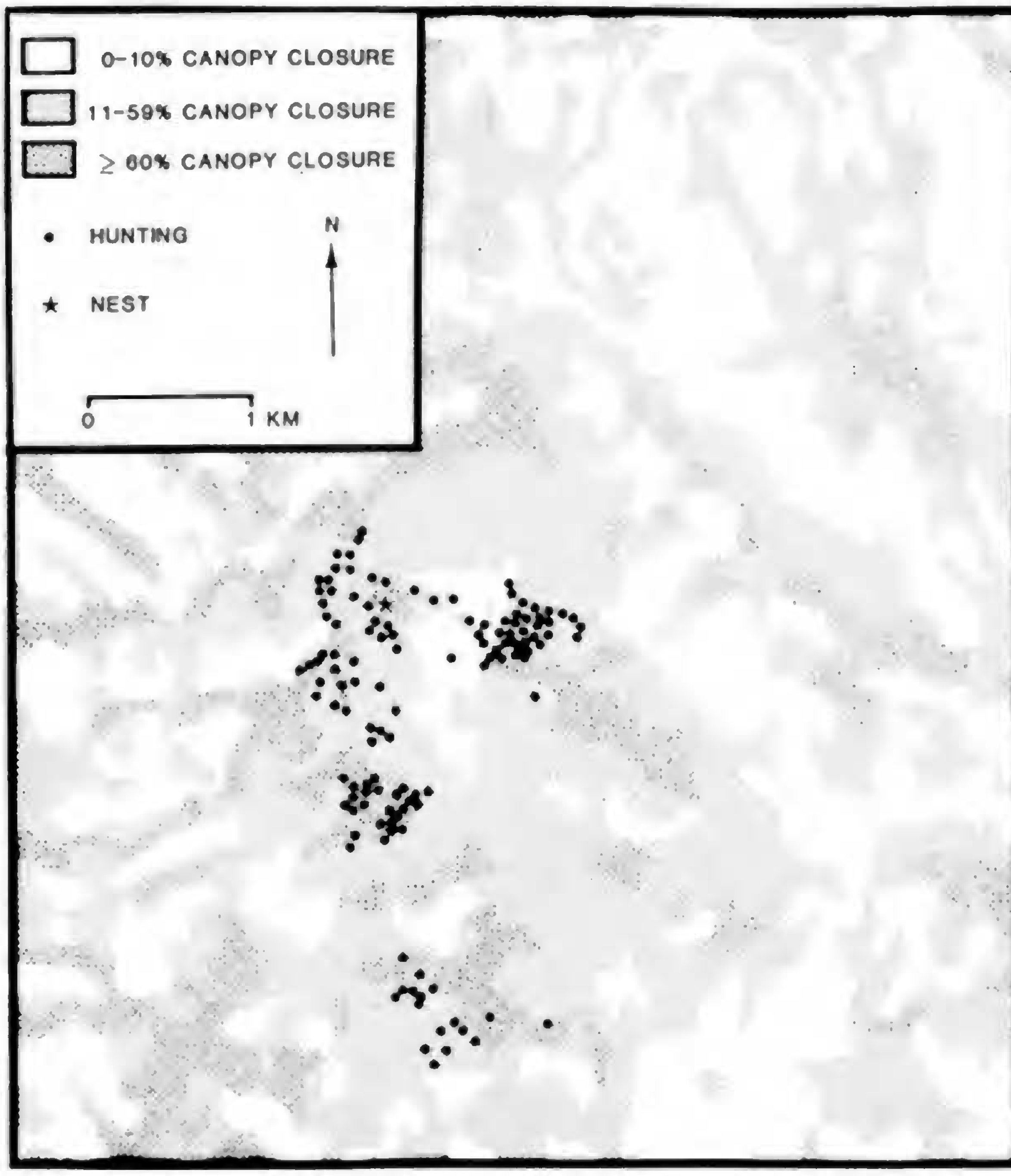

Figure 3. Locations at 15-min intervals of a hunting male Great Gray Owl in Spring study area during daylight. Observations were made on 10 d from 1 April–22 July 1985.

there. Open stands of mature forests were used most for foraging, while subclimax and dense over-mature stands and clearcuts were used less frequently. Winter (1986) reported that Great Gray Owls foraged primarily in or along meadow edges; Franklin (1987) found them foraging in clearcuts. Factors that are important in foraging habitats include high prey density, perch availability and forests that are open enough to allow birds to move freely.

Relatively close spacing of some nesting pairs in Oregon support the belief that Great Gray Owls defend only the immediate vicinity around a nest (Bull and Henjum 1987). Höglund and Lansgren (1968) reported pairs within 100 m of each other in Sweden; Mikkola (1976) reported 3 nests within 400 m of each other in Finland; and Wahlstedt (1974) reported 5 pairs within 3 km in April. More recently, Lehtoranta (1986) found 2 nests in Finland only 49 m apart, but since only 1 male was seen, polygamy seems possible.

Because the species does not generally maintain mutually exclusive territories, fairly high densities can be obtained. Mikkola (1981) reported 8 nests in 100 km^2 in Finland, and Wahlstedt (1974) found 5 nests and an additional 4 pairs that he believed were nesting in a 100 km^2 area in Sweden. In Oregon we found the highest density of nesting Great Gray Owls reported for either North America or Europe.

ACKNOWLEDGMENTS

We are grateful to R. G. Anderson, H. A. Akenson, J. Akenson, H. D. Cooper, S. P. Feltis, E. D. Forsman, R. Googans, R. A. Grove, W. I. Haight, J. S. Henderson, J. E. Hohmann, M. Hunter, M. D. Snider, M. E. Walker, and W. G. Williams.

Funding was provided by the USDA Forest Service's Pacific Northwest Research Station and Oregon Department of Fish and Wildlife Nongame Fund. Additional assistance was provided by Wallowa Valley Ranger Station, La Grande Ranger Station, and North Fork John Day Ranger Station.

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Received 1 April 1988; accepted 20 September 1988